

REMARKS

Upon entry of this amendment, Claims 1-6, 8-11, 13-15, 17-18, 22-24, 27-32, 40-45, 48-51, 54-58 and 62-78 are currently pending in the present file wrapper continuation application, including independent Claims 1, 62 and 63. Claim 62 was added by the First Preliminary Amendment. Claims 63-78 have been added by the present amendment.

New Claims 63-78 presented herein claim in whole or at least in part substantially the same subject matter as Claims 1-9, 13-15, and 17-20, respectively, of Buter U.S. Patent No. 5,043,438. Since the Buter '438 patent issued on August 27, 1991, the one-year time limit imposed by 35 U.S.C. §135(b) has been met.

Applicants point out that the Buter '438 patent is the subject of a recent Request for Reexamination, notice of which was published at 1139 OG 8 (June 2, 1992) (copy enclosed). See MPEP §§2307.04, 2284. Applicants' counsel have reviewed this Request for Reexamination on file in the PTO, and are not aware of any references more pertinent than those of record in the Request for Reexamination and in applicants' parent application, Serial No. 07/580,706.

Support for new Claims 63-78 can be found in the specification of the present application as shown in the following table:

APPLICATION CLAIMS

63. A process for the synthesis of polyol fatty-acid polyesters

SUPPORT IN APPLEBY ET AL. APPLICATION

Page 1, lines 13-14: "This invention relates to improved synthesis of higher polyol fatty acid polyesters."

APPLICATION CLAIMS

by reacting a polyol and

a fatty-acid lower-alkyl ester

under substantially solvent free
conditions

in the presence of a catalyst and

an emulsifier,

SUPPORT IN APPLEBY ET AL. APPLICATION

Page 2, lines 29-31: "The present invention relates to . . . interesterifying (a) polyol containing more than about four esterifiable hydroxy groups. . ."

Page 2, lines 32-33: ". . . and (b) fatty acid ester of easily removable alcohol."

Page 5, lines 26-33: "As used herein, the terms 'fatty acid ester(s)' and 'ester reactant(s)' . . . are preferably esters of volatile alcohols, e.g., the C₁-C₄ (preferably methyl) [i.e., lower alkyl] . . . esters of fatty acids containing about eight or more carbon atoms."

Page 1, lines 13-16: "This invention relates to improved synthesis of higher polyol fatty acid polyesters . . . via transesterification reactions that do not use a solvent to form a homogeneous reaction mix."

Page 2, lines 34-35: "in the absence of any substantial amount of unreactive solvent."

Page 3, lines 5-7: "The process is a continuous process in which the initial catalyst level is from about 0.01 to about 0.5 moles of catalyst per mole of polyol. . . ."

Page 11, lines 25-27: "The basic catalysts generally suitable for use in preparing the polyol polyesters described herein are"

Page 3, lines 9-10: "The initial level of

APPLICATION CLAIMS

the process comprising:
an initial reaction stage

which is carried out under such
conditions that the reaction mixture in said
initial stage is in steady-state with
continuous introduction of reactants

SUPPORT IN APPLEBY ET AL. APPLICATION

soap emulsifier in the first stage of the
reaction is from about 0.001 to about 0.6,
preferably from about 0.2 to about 0.4
moles per mole of polyol."

Page 24, lines 37-38: "In general it is
desirable, and even preferred, to effect the
reaction in at least two stages."

Page 19, lines 19-20: "It is desirable in
the initial stage, or stages, of the process,
and especially of a continuous process, to
have a relatively high degree of
completion."

Page 1, lines 13-17: "This invention
relates . . . more specifically to a
continuous process. . . ."

Page 36, lines 5-6: "The continuous
reactor is started up and allowed to reach
steady state."

Page 42, lines 9-14: ". . . continous
operation is started with the feed slurry
introduced into the first reactor and the
intermediate product from the first reactor
cascading to the second and so on down
the train. The reactors are allowed to
reach steady-state with the average
composition at steady-state exiting from
each reactor about the following. . . ."

Page 19, lines 14-18: "In a continuous
reaction, the individual reactants can be
added to the first stage at a rate that
maintains the desired degree of
esterification and yet provides sufficient
yield from the first stage to maintain the

APPLICATION CLAIMS

comprising polyol and fatty-acid
lower-alkyl ester, and

continuous removal of products
comprising reaction mixture having a
degree of esterification of 10% or more
and

SUPPORT IN APPLEBY ET AL. APPLICATION

reaction in the subsequent stage, or
stages."

Page 20, lines 5-7: ". . . reactants are
continually added and the product is re-
moved at rates that maintain the desired
level of esterification."

Page 24, lines 27-31: "an initial
heterogenous reaction mixture comprises
. . . polyol [and] . . . fatty acid ester
. . . ."

Page 5, lines 26-31: ". . . the terms 'fatty
acid ester(s)' . . . are preferably esters of
volatile alcohols, e.g., the C₁ - C₄
(preferably methyl) . . . esters of fatty
acids. . . ."

Page 42, lines 9-14: ". . . continous
operation is started with the feed slurry
introduced into the first reactor and the
intermediate product from the first reactor
cascading to the second and so on down
the train. The reactors are allowed to
reach steady-state with the average
composition at steady-state exiting from
each reactor about the following. . . ."

Page 20, lines 5-7: ". . . reactants are
continually added and the product is re-
moved at rates that maintain the desired
level of esterification."

Page 19, lines 3-6: "It is highly desirable
to conduct the initial stage . . . to maintain
the degree of esterification between about
10% (preferably 20%) and about
70%. . . ."

APPLICATION CLAIMS

SUPPORT IN APPLEBY ET AL. APPLICATION

Page 36, lines 5-11: "The continuous reactor is started up and allowed to reach steady state. . . . At steady state the product exiting from the continuous reactor has an average composition of about 3.05 fatty acid chains per molecule of sucrose. . . ." "Degree of esterification" is defined at page 2, lines 18-23, as the percentage "of the total number of available hydroxy groups on the polyol [that] are esterified with a fatty acyl radical." Thus, 3.05 fatty acid chains per molecule of sucrose (which has 8 available hydroxyl groups) is equivalent to $3.05 \div 8$, or 38.125% esterification.

See also Examples 14 (pages 41-42) and 16 (pages 43-44), giving details of continuous processes and steady state composition of the effluent partial esters.

volatile alcohol formed during the initial reaction stage, and

Page 3, line 37 - Page 4, line 5: "The said easily removable alcohol is a volatile alcohol . . . and the removal of the volatile alcohol produced by the reaction between the ester reactant and the polyol is assisted by increasing the mass transfer area of the reaction mixture . . . and/or sparging. . . ."

one or more subsequent reaction stages in which the reaction mixture from said initial stage is further reacted to said polyol fatty-acid polyesters.

Page 24, lines 37-38: "In general it is desirable, and even preferred, to effect the reaction in at least two stages. . . ."

Page 19, lines 14-18: "In a continuous reaction, the individual reactants can be added to the first stage at a rate that maintains the desired degree of esterification and yet provides sufficient

APPLICATION CLAIMS

64. The process according to Claim 63 wherein the reaction mixture from the initial stage is further reacted to said polyol fatty-acid polyesters after combining with any remaining part of the fatty-acid lower-alkyl ester reactant.

65. A process according to Claim 63 wherein the emulsifier is an alkali metal soap.

SUPPORT IN APPLEBY ET AL. APPLICATION

yield from the first stage to maintain the reaction in the subsequent stage, or stages."

Page 4, lines 23-28: "The final stage, or stages, of the reaction are carried out . . . after the degree of esterification of said polyol has reached at least about 50% to achieve a final degree of esterification of at least about 70%, preferably at least about 95%."

Page 21, lines 25-37: "The final stage, or stages, of the reaction should be carried out under . . . conditions to . . . achieve high degrees of esterification. . . . The final degree of esterification should be at least about 70%, preferably at least about 98%."

Page 19, lines 31-36: "Maintenance of the appropriate composition for solubilizing the polyol is assisted by withholding a portion of the ester reactant from this initial stage In the initial stage, it is preferable to use only about 30% to about 70% of the total ester reactant, with the remainder being added in the later stages."

Pages 25, lines 1-3: "In any later stage, additional fatty acid esters . . . can be added."

Page 11, lines 7-8: "Alkali metal soaps are typically, and preferably, used as emulsifiers in the processes described herein."

APPLICATION CLAIMS

66. A process according to Claim 65 wherein the alkali metal soap is selected from the group of soaps having a chain length within the range of from 8 to 22 carbon atoms.

67. A process according to Claim 63 wherein the fatty-acid lower-alkyl ester is a fatty-acid methyl ester.

68. A process according to Claim 63 wherein the catalyst is selected from the group consisting of potassium hydroxide and carbonates of potassium and sodium.

69. A process according to Claim 63 wherein the reaction mixture in said initial reaction stage has a degree of esterification of within the range of from 10 to 60%.

SUPPORT IN APPLEBY ET AL. APPLICATION

Page 11, lines 9-12: "the term 'alkali metal fatty acid soap' is intended to include the alkali metal salts of saturated and unsaturated fatty acids having from about 8 to about 18 carbon atoms."

Page 11, lines 20-24: "In a preferred process, . . . it is highly desirable that any soap present be an alkali metal . . . salt of hydrogenated fatty acids containing from about 16 to about 22 carbon atoms."

Page 5, lines 26-34: "As used herein, the terms 'fatty acid ester(s)' and 'ester reactant(s)' are intended to include any compound wherein the alcohol portion is easily removed, . . . but are preferably esters of volatile alcohols, e.g., the C₁-C₄ (preferably methyl) . . . esters of fatty acids. . . . Methyl esters are the most highly preferred ester reactants."

Page 11, lines 35-38: "In another particularly preferred embodiment of the present invention, the basic catalyst used in the reaction is potassium carbonate, sodium carbonate. . . ."

Page 34, lines 32-33: "The catalyst in this reaction is the residual KOH [potassium hydroxide] in the soap."

Page 19, lines 3-6: "It is highly desirable to conduct the initial stage . . . to maintain the degree of esterification between about 10% (preferably 20%) and about 70%, preferably between about 35% and about 60%."

APPLICATION CLAIMS

70. A process according to Claim 63 wherein the reaction mixture in said initial stage does not contain any substantial amount of solvent.

71. A process according to Claim 63 wherein the reaction temperature in said initial stage is maintained at a level of within the range of from 130° to 140°C.

72. A process according to Claim 63 wherein the average residence time of the reaction mixture in said initial stage is caused to be about 1.5 hours.

73. A process according to Claim 63 wherein the molar ratio of catalyst to polyol in said initial reaction stage is within the range of from about 0.01:1 to about 0.5:1.

74. A process according to Claim 63 wherein the molar ratio of emulsifier to polyol in said initial reaction stage is within the range of from 0.2:1 to 0.6:1.

SUPPORT IN APPLEBY ET AL. APPLICATION

Page 2, lines 34-35: "in the absence of any substantial amount of unreactive solvent."

Page 1, lines 13-16: "This invention relates to improved synthesis of higher polyol fatty acid polyesters . . . that do not use a solvent to form a homogenous reaction mix."

Page 18, lines 2-5: "It is highly preferable to run the reaction in the initial stages at temperatures between about 265°F (130°C) and about 285°F (140°C), preferably between about 270°F (132°C) and about 275°F (135°C)."

Page 35, lines 30-32: "Examples 9 and 10 make use of a 3-liter continuous stirred tank reactor (CSTR) to perform the first stage of the reaction. The residence time of this reactor is about 1.5 hours."

Page 36, lines 6-7: "The reactor conditions are . . . about 1.5 hours residence time."

Page 3, lines 5-7: "The process is a continuous process in which the initial catalyst level is from about 0.01 to about 0.5 moles of catalyst per mole of polyol, preferably from about 0.01 to about 0.1 mole of catalyst per mole of polyol."

Page 11, lines 7-8: "Alkali metal soaps are typically, and preferably, used as emulsifiers in the processes described herein."

APPLICATION CLAIMS

75. A process according to Claim 63 for the synthesis of polyol fatty-acid polyesters having a degree of esterification of at least about 70%.

76. A process according to Claim 63 wherein the polyol is sucrose.

77. A process according to Claim 76 wherein the molar ratio of fatty-acid lower-alkyl ester to sucrose is within the range of from 7.2:1 to 15:1.

SUPPORT IN APPLEBY ET AL. APPLICATION

Page 15, lines 15-17: "The level of soap in the first stage of the reaction is desirably from about 0.001 to about 0.6, preferably from about 0.2 to about 0.4 moles of soap per mole of polyol."

Page 21, lines 36-37: "The final degree of esterification should be at least about 70%, preferably at least about 98%."

Page 4, lines 34-35: "In practicing the process disclosed herein, sucrose is the most highly preferred polyol."

Page 25, lines 3-7: "In any second, or later step, additional fatty acid ester can be added to raise the overall ratio of fatty acyl groups to the esterifiable hydroxy sites on the polyol to from about 0.9:1 to about 1.4:1 [since sucrose has 8 esterifiable sites, this translates to about 7.2:1 to about 11.2:1 moles ester to moles sucrose], preferably from about 1:1 to about 1.2:1 [about 8:1 to about 9.6:1 moles ester to moles sucrose]."

Page 30, lines 17-28: "To perform the first stage of the reaction, about 148 grams of partially hardened soybean methyl esters (0.5 mole) are added to the reactor To this mixture is added about 34.2 grams of crystalline sucrose (0.1 mole). . . . To perform the second stage of the reaction, about 207 grams of partially hardened soybean methyl esters (0.7 mole) . . . are added to the reactor." [Total esters 1.2 mole, total sucrose 0.1 mole; overall molar ratio = 12:1.]

APPLICATION CLAIMS

SUPPORT IN APPLEBY ET AL. APPLICATION

78. A process according to Claim 63 wherein said initial reaction stage is fully separate from said one or more subsequent reaction stages.

Page 34, lines 34-37: "About . . . 25 grams of sucrose (0.073 moles) . . . and about 320 grams of partially hardened soybean methyl esters (1.094 moles) are added to the reactor." [Molar ratio = 15:1].

Page 24, lines 37-38: "In general it is desirable, and even preferred, to effect the reaction in at least two stages."

Page 21, lines 13-21: "It is advantageous . . . to carry out the reaction in a series of at least two, preferably from two to about eight, more preferably from three to about eight, reaction vessels. . . . Separate vessel/reactors allow for closer control. . . . Separate vessels are also particularly desirable. . . ."

Page 40, lines 4-8: "This example demonstrates the ability to utilize a series of three Continuously Stirred Tank Reactors (CSTR) for the first stage of a reaction to make sucrose polyesters . . . and then completing the second stage of the reaction in a batch reactor."

Pursuant to the provisions of 37 C.F.R. §1.607, and in view of the foregoing amendments and accompanying remarks, Applicants respectfully request that an interference be declared between the common claimed subject matter of the present application and Buter U.S. Patent No. 5,043,438.

In particular, it is proposed that the interference be declared with a single count, reading substantially as Buter '438 patent Claim 1 and applicants' Claim 63, as follows:

PROPOSED COUNT I

A process for the synthesis of polyol fatty-acid esters by reacting a polyol and a fatty-acid lower-alkyl ester under substantially solvent free conditions in the presence of a catalyst and an emulsifier, the process comprising

an initial reaction stage which is carried out under such conditions that the reaction mixture in said initial stage is in steady-state, with continuous introduction of reactants comprising polyol and fatty-acid lower-alkyl ester, and continuous removal of products comprising reaction mixture having a degree of esterification of about 1% or more and volatile alcohol formed during the initial reaction stage of the synthesis, and

one or more subsequent reaction stages in which the reaction mixture from said initial stage is further reacted to said polyol fatty-acid esters.

It is proposed that the interference be declared with Buter '438 patent Claims 1-21 and so much of applicants' Claims 63-78 as correspond exactly to the Buter claims be designated as unpatentable over the interference count.

Proposed Count I is written in the language of applicants' Claim 63, but is believed broad enough to encompass both applicants' Claim 63 and Buter Claim 1. Like Buter Claim 1, the count recites a process for the synthesis of "esters," rather than being limited to the subcategory "polyesters," and recites a degree of esterification in the first stage of the reaction of "about 1% or more," rather than being limited to applicants' narrower

range "about 10% or more." Thus, the proposed count is not narrower than Buter Claim 1, the broadest claim of the Buter patent. See 37 C.F.R. §1.606.

The differences in language between applicants' Claim 63 and Buter patent Claim 1 are such that both of these claims are nevertheless drawn to the same subject matter.

The language of Claim 63 of the present application is identical to that of Buter '438 patent Claim 1, except that:

(1) Claim 63 is directed to a process for the synthesis of --polyol fatty-acid polyesters-- instead of "polyol fatty-acid esters". Both claims are drawn to substantially the same subject matter, however, since the process claimed in the Buter '438 patent can be used to synthesize both "esters" and "polyesters", the only difference being the degree of completion to which the reaction is allowed to run. Indeed, the Buter patent is directed to the synthesis of both polyol fatty acid esters and polyesters; Buter dependent Claim 16 specifically claims the synthesis of polyesters. Moreover, the Buter patent indicates that the process is particularly directed to the synthesis of polyesters, although it is "suitable" also for synthesis of oligoesters. Col. 6, Ins. 53-56. Buter patent Example 1 discloses the synthesis of sucrose polyester with 96.6% conversion. Col. 8, Ins. 18-20.

(2) Claim 63 (as well as Claims 68 and 73) omits the word "transesterification" before "catalyst." This is not a difference in substance, since the reaction which is described in the instant application, in which the catalyst used, is in fact a transesterification reaction, as indicated on page 1, lines 13-15. One of ordinary skill in the art would know that the type of catalyst called for in a transesterification reaction is inherently a "transesterification catalyst."

(3) Claim 63, as well as Claims 64, 69-74 and 78, refer to initial and subsequent reaction "stages," like Buter Claim 1, but omit the terminology referring to first and subsequent reaction "zones." This is simply a difference in wording which does not change the fact that substantially the same subject matter is involved. Both applicants' disclosure and the Buter '438 patent are directed to a reaction having at least two distinct stages. (See discussion of support for Claim 63, above.) The Buter patent states that the first stage is carried out in a "first reaction zone" which may be a reaction vessel separate from one or more further reaction vessels or may be part of multi-zone continuous esterification equipment which, in turn, may be "a serial sequence of separate reaction vessels." Col. 3, lines 3-8. Similarly, the instant application discloses that a "series of reaction vessels and/or separate reactors" should be used in the reaction (Page 21, lines 16-17) and that in one embodiment, the reaction is done "using two backmix reactors in series for the initial stage."

(4) Claim 63 refers to the --continuous introduction of reactants-- and --continuous removal of products-- rather than "in-going reactant streams" and "out-going product streams." This difference again merely represents two ways of describing the same aspect of the same reaction scheme. Claim 63 uses the term --continuous-- instead of Buter's term "massbalanced" to refer to the fact that the first stage of the reaction involves a continuous inflow of reactants and a continuous outflow of the steady state reaction mixture of product and reactants. This does not represent a change in substance. A person of ordinary skill in the art would know that for a process to be in steady state, the rate of mass continuously entering the system must equal the rate of mass continuously leaving, i.e. there

must inherently be "mass balance". See, e.g., Unit Operations of Chemical Engineering, 3d Ed. by McCabe and Smith, (McGraw-Hill, 1976) at page 66 (copy enclosed). A continuous process must operate in steady state and be mass balanced except during start-up. See, e.g., Elementary Principles of Chemical Processes by Felder et al. (Wiley 1978), page 82 (copy enclosed). Felder et al. define a "continuous process" as a process where "[t]he inputs and outputs flow continuously through the duration of the process." Felder et al. indicate that if "all the variables [including rate of inflow and outflow] in a process do not change with time, except possibly for minor fluctuations about constant mean values, the process is said to be operating at steady state." Felder et al. state that "[c]ontinuous processes are usually run as close to steady state as possible; unsteady-state (transient) conditions exist during the start-up of a process and following changes - intentional or otherwise - in process operating conditions." Thus, a person of ordinary skill in the art would know that where there is "continuous introduction of reactants" and "continuous removal of products" and the reaction is in steady state (i.e., after start-up), the inflows and outflows must inherently be "massbalanced." Otherwise, the reaction vessel would either fill up and reach its capacity, or empty out, and the process would cease to be continuous or in steady state. The Buter '438 patent at col. 2, lns. 24 and 42 makes clear that the patent is directed to a continuous process, as is the instant application (page 1, line 17). Indeed, in the prosecution history of the Buter '438 patent, the Examiner noted in his "reasons for allowance" that Buter claimed "a continuous initial reaction stage."

(5) Claim 63 recites a --a degree of esterification of about 10% or more-- instead of "a polyol conversion of 1% or more" as set out in Buter Claim 1. "Polyol

conversion" is defined in the Buter patent as "the percentage of polyol hydroxyl groups of the original polyol that on average have been esterified with fatty acids." Buter patent col. 1, ln. 32-37. Similarly, at page 2, lines 18-23 of the present application, the term "degree of esterification" is used to mean the percentage "of the total number of available hydroxy groups on the polyol [that] are esterified with a fatty acyl radical." Applicants' specification does not disclose polyol conversion below 10% in the initial stage. But even the Buter patent makes clear that the 1% is not a critical lower limit. Indeed, Buter teaches that the preferred first stage conversion is at least 10% (col. 3, line 31). Moreover, the lowest polyol conversion disclosed in the examples of the Buter patent for the first stage of the process is 10.3% (Example 4, col. 9, ln. 56), while other Buter examples show first stage conversions of 25.6% (Example 2), 32.2% (Example 3), and 41.5% (Example 5). Under these circumstances, an interference is properly declared between applicants' Claim 63 and Buter's Claim 1 using the 1% value set out in Buter's claim. See MPEP §2309.01.

(6) Claim 63 refers to the --volatile alcohol-- formed during the initial stage of the synthesis instead of a "lower-alkyl alcohol." Given that the reactants are a polyol and a lower-alkyl fatty acid ester, the products of the transesterification reaction will inherently be polyol fatty-acid esters and a lower-alkyl alcohol, which is inherently volatile. Moreover, while Buter Claim 1 refers to the lower-alkyl alcohol as part of the out-going product "streams," the Buter '438 patent makes clear that it is removed as a vapor. '438 patent col. 5, ln. 55 - col. 6, ln. 7.